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ABSTRACT

This study, conducted at Northeastern Illinois University, examined gender differences in professional goals of 95 degreed, professionally experienced students seeking secondary certification in mathematics and science (50 females and 45 males). An analysis of the stated goals found that all goals could be assigned to the following 10 categories: (1) fostering students' interest in mathematics and the natural sciences; (2) stimulating students' interest in mathematics and science related careers; (3) promoting students' academic achievement in mathematics and science; (4) promoting the development of students as whole persons; (5) serving as positive role models for students; (6) achieving one's own professional goals and gaining personal satisfaction; (7) fully utilizing and sharing academic and professional expertise; (8) making a contribution to the larger community; (9) eliminating students' fear and anxiety related to mathematics and science; and (10) addressing gender issues in mathematics and science. Gender differences were found in most of these categories. For example, the greatest difference was related to goal 6 (55 percent of males and 28 percent of females noted this as a goal), and goal 4 (56 percent of females and 35 percent of males). The findings suggest that teacher educators who are sensitive to the possibility of gender differences in their students' goals can assist these preservice teachers in developing and attaining more comprehensive and broad-ranging goals that will positively impact the future teachers' secondary students. (ND)

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ABSTRACT

GENDER DIFFERENCES IN THE PROFESSIONAL GOALS OF PRESERVICE SECONDARY MATHEMATICS AND SCIENCE TEACHERS

by Sandra Styer

There have been few gender studies of preservice and inservice teachers. Despite the fact that teaching is a female-dominated profession, an understanding of gender differences is still critical especially in those traditionally male-dominated fields such as mathematics and science education. This study examined 95 preservice secondary mathematics and science teachers' gender differences in their professional goals. An analysis of the stated goals elicited in a program application process found that all goals could be assigned to ten major categories. Gender differences were found in most of these categories. Teacher educators who are sensitive to the possibility of gender differences in their students' goals can assist these preservice teachers in developing and attaining more comprehensive and broad-reaching goals which will positively impact the future teachers' secondary students.

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GENDER DIFFERENCES IN THE PROFESSIONAL GOALS OF PRESERVICE SECONDARY MATHEMATICS AND SCIENCE TEACHERS

Identifying the professional goals of preservice teachers can be invaluable to teacher educators charged with planning and modifying the teacher education curriculum. Statements of students' professional goals are readily available, often as part of a program/college admission process. A detailed knowledge of preservice teachers' goals can assist teacher educators in better understanding and meeting their students' professional needs. Furthermore, with this information teacher educators can encourage students to re-examine their current goals while considering the adoption of additional ones more consistent with specified program goals.

Knowledge of students' goals is especially significant in planning programs to effectively meet the needs of the increasingly large population of degreed men and women returning to prepare for teaching as a second career. Typically, these are mature, well-educated, professionally experienced individuals with a strong sense of purpose. They are likely to have well-articulated goals which will serve to guide them as they pursue teacher certification.

Teacher educators reviewing students' goal statements are likely to be impressed by the impact of apparent differential personal values and experiences upon the content of

these goals. Certainly, gender could be hypothesized as one significant influence on the development of these preservice teachers' values and experiences and subsequently on the articulation of goals. During the past decade, there has been abundant gender differences research exploring the impact of gender on individuals' professional as well as personal lives. Cook has discussed this "gendered context of life" related to career planning and has referred to gender experts who have contended that:

> "...the sexes generally develop different orientations to life, in that men tend to define themselves and their lives primarily through independent, goal-directed, assertive activity, and women through interdependent nurturing relationships with others." (Cook, 1993, p. 229)

The current study was conducted at Northeastern Illinois University, a public university serving the Chicago metropolitan area with an enrollment of approximately 10,000. Northeastern has had a long history of preparing teachers for the metropolitan area.

This study examined the stated goals of a special group of preservice secondary mathematics and science teachers applying for program admission to determine whether or not there were any evident gender differences. These students were degreed and professionally experienced individuals returning to school to seek teacher certification. The decision to limit the analysis to the goals of this special group was motivated by the assumption that it might be a particularly interesting population given the traditional perception that mathematics and science are "male" fields. It was believed that any gender differences found in this group would be especially important to identify and

address as part of the effort to ensure gender equity specific to secondary mathematics and science education. Because they were degreed and professionally experienced, it could be assumed that these students had had more time than the typical undergraduate teacher certification candidate to have experienced the "gendered context of life" to which Cook referred. Furthermore, nationwide this population of returning adults is becoming a more significant constituency in teacher education.

SUBJECTS AND METHOD

The ninety-five students selected for this study each held at least one academic degree and had reported working in a professional/technical position for at least one year prior to their application for admission to a secondary certification program in mathematics or science (biology, chemistry, earth science, or physics). All applicants had applied in the period from 1991 to 1994.

When degreed students apply for certification program admission at Northeastern, they are required to complete an application form which elicits typical demographic data and asks them to respond fully to the following two items:

- Describe your career history since you earned your bachelor's degree.
- What do you hope to accomplish by becoming a teacher?

Of the 95 total students, 50 (53%) were females and 45 (47%) were males. Sixty-one were seeking secondary certification in mathematics; of these, thirty-five (57%) were females and 26 (43%) were males. Thirty-four were seeking secondary certification in an area of science; of these, 19 (56%) were male and 15 (44%) were female. The mean age

of the total group was 32 years. The mean age of males was 31 years; the mean age of females was 33 years.

A total of twenty-five students (26% of the total) had been awarded graduate degrees. Seven (14%) of the females held graduate degrees; six had master's degrees and one had a doctor of veterinary medicine degree. Eighteen (40%) of the males held graduate degrees. Fourteen had master's degrees. Of these fourteen, three held two master's degrees and one had completed the doctorate except for the dissertation. In addition, four males held doctorates including two doctor of philosophy degrees, one doctor of dental surgery degree and one doctor of veterinary medicine degree.

Responses to the "career history" item on the application documented a group of individuals with extraordinary professional backgrounds which would undoubtedly enrich their secondary teaching. Both females and males reported varied career histories since earning their bachelor's degrees. These careers included ones related and unrelated to the fields of mathematics and science. A number of the males and females with degrees in mathematics and science who had been engaged in careers unrelated to their degrees nevertheless had challenging careers which could be expected to add a special dimension to the preservice teacher's background. While no one had been a certified teacher, some of these men and women had held positions with instructional responsibilities in business and industry. Some had had volunteer teaching and tutoring experiences. Certainly, these varied work experiences helped them to formulate their goals as preservice teachers.

Males seeking certification as secondary mathematics teachers had been in

mathematics related positions such as electrical engineer, accountant, computer programmer, controller of a manufacturing company, and actuary for a large insurance company. Similarly, females had held such positions as computer programmer, accountant, corporate financial analyst, and statistician.

Some of the males' careers not directly related to mathematics included professional football player, store manager, worker on the floor of the Chicago Board of trade, cabinetmaker, restaurant owner, and golf course manager. Females' careers not directly related to mathematics included those in bank loan administration, marketing, merchandising, choreography, computer graphics, and convention management.

Males seeking certification as secondary science teachers reporting on their career histories related to science noted such former employment as electrical engineer, chemical engineer, systems engineer, food chemist, veterinarian, and geologist. Females indicated such positions as chemical engineer, medical technologist, horticulturist, pharmacy technician, and laboratory technician. Males and females reported such diverse careers not directly related to science as video production, bookstore manager, pianist for Second City ballet, art coordinator for a book publisher, and real estate agent.

Males and females pursuing mathematics and science certification reported that they had had teaching responsibilities as part of their overall assignment or full-time in positions not requiring certification. These were often part-time teaching assignments in local community colleges and technical institutes. One had taught mathematics in a college in Pakistan. One had worked in a drop-out prevention project as a member of the

Jesuit Volunteer Corps. One had served as a school library volunteer; another had been a literacy volunteer teaching adults to read. Some of the students acknowledged that their interest in teaching was stimulated by these experiences. A few had served as substitute teachers in secondary schools and several had been involved in teaching in corporate training programs.

Responses to the application question seeking information on what they hoped to accomplish by becoming a teacher prompted some very reflective responses. Since the question was open-ended, the number of responses or goals identified by each individual differed ranging from one to five.

After an exhaustive review of these goals, it was determined that all goals could be clustered into ten relatively distinct categories. Each of the individual responses of males and females were then assigned to one of the ten categories. The number and percentage of males and females who had indicated a goal(s) in each category was then ascertained. These percentage distributions are presented in Table 1.

TABLE 1
Percentage Distributions of Professional Goals of Preservice Secondary Mathematics and Science Teachers Related to Gender

Goal		Females		Males	
		Number	Percent	Number	Percent
1.	To foster student's interest in mathematics and the natural sciences	11	22	5	11
2.	To stimulate students' interest in mathematics and science related careers	4	8	4	9
3.	To promote students' academic achievement (knowledge, attitudes, and skills) in mathematics and science	17	34	12	26
4.	To promote the development of students as whole persons	28	56	16	35
5.	To serve as a positive role model for students	8	16	3	6
6.	To achieve their own professional goals and gain personal satisfaction	14	26	25	55
7.	To fully utilize and share their academic and professional expertise	15	30	15	33
8.	To make a contribution to the larger community	2	4	1	2
9.	To eliminate students' fear and anxiety related to mathematics and science	5	10	1	2
9.	To address gender issues in mathematics and science	3	6	0	0

RESULTS

A comparison of the percent of females and males who specified goals in each of the ten categories shows substantial differences in most categories.

The greatest difference was related to the goal: to achieve their own professional goals and gain personal satisfaction (Goal 6). Fifty-five percent of the males and 28 percent of the females noted this as a goal. The goal with the second greatest difference was: to promote the development of the student as a whole person (Goal 4) with 56 percent of the females and 35 percent of the males indicating this goal. To foster student interest in mathematics and the natural sciences (Goal 1) was a goal of 22 percent of the females and 11 percent of the males. To serve as a positive role model for students (Goal 5) was noted by 16 percent of the females and six percent of the males. Thirty-four percent of the females and 26 percent of the males listed Goal 3: to promote students' academic achievement (knowledge, attitudes, and skills) in mathematics and science. Ten percent of the women and two percent of the men noted Goal 9: to eliminate students' fear and anxiety related to mathematics and science. Finally, it should be noted that six percent of the females but no males expressed the goal of addressing gender issues in mathematics and science (Goal 10). For three of the goals, females and males responded rather similarly. These included the goal of stimulating students' interest in mathematics and science-related careers (Goal 2); of fully utilizing and sharing their academic and professional expertise (Goal 7); and of making a contribution to the larger community

(Goal 8).

DISCUSSION

Examining the gender differences in preservice secondary mathematics and science teachers' professional goals can highlight the need to foster an awareness in females and males of the range of possible goals. This can be most readily achieved through class discussions. These goals as well as others which might emerge in a classroom discussion could be reflected upon. What are the implications of each of the goals for the students' professional development? Given the gender differences which became evident in this study, discussion could focus upon how the differences in females' and males' socialization might underlie some of these differences in stated goals.

Titus has suggested that teacher education programs often accomplish little in developing an understanding of gender and has explained that:

> "Future teachers are left with analyses of schooling that lack a critical understanding of the ways power has been used to favor some students over others, that show little understanding of the ways in which the hidden curriculum works differently for male students than for females, and that provide only a cursory treatment of the sociopolitical context of schooling." (Titus, 1993, p. 42).

It is clear from Titus' analysis that educational foundations courses must assume some of the responsibility for preparing teachers with an in-depth understanding of this sociopolitical context of schooling. Collaborative class discussion would facilitate such understanding.

In light of the dramatic gender difference in the goal of achieving their own

professional goals and gaining personal satisfaction, preservice teachers could discuss why females might be more reluctant than males to state this goal. Furthermore, how might a commitment to this goal on the part of males and females not only enhance their lives but also their long-term contributions to the profession?

The distinct gender difference in goal 4 related to promoting the development of students as whole persons could be discussed in terms of the importance of the goal and the role of women as caretakers in our society.

Given that only 35% of the males and 56% of the females in this study cited promoting the development of students as whole persons as a professional goal, it would seem that this goal needs special consideration in the teacher education curriculum. In discussing this ethic of caring, Rogers and Webb have proposed that prospective teachers must "...have the chance to observe real teachers, in both their university-based programs and in their practicums, who model caring and who reflect upon, discuss, and evaluate their practice in terms of the ethic of caring." (Rogers and Webb, 1991, p. 178). An ethic of caring allows teachers to expand their focus of concern from the academic to the total development of the student.

The finding that 16 percent of the women as compared to six percent of the men wanted to serve as a positive role model for students (Goal 5) was interesting. It could be speculated that females who have traditionally been in the minority in mathematics and science fields would be particularly sensitive to the importance of role models.

Dunlap and Reynolds reported on a summer science institute for inservice

elementary teachers which could offer models for secondary science and mathematics education programs. Institute instructors were selected from the community with consideration to gender. Community women in science were recruited "...to present lessons, to serve as positive science role models for the teachers, to serve as community resources during the school year, and to serve as positive science role models for girls in elementary school." (Dunlap and Reynolds, 1994, p. 289). Such use of community women as role models could be expected to impact preservice as well as inservice teachers' concepts of gender.

The finding that only three females and no males indicated the goal of addressing gender issues in mathematics and science (Goal 10) suggests the need for females and males to become more aware of gender issues.

Future related studies could explore the relationship of age to gender differences. Also, there could be investigations of gender differences of preservice teachers in other secondary subject areas as well as other age/grade levels such as elementary and early childhood. It would be intriguing to study individual preservice teachers in some depth perhaps conducting case studies which could provide insight into the impact on goal formation of the differential professional employment backgrounds brought to the teaching profession by these degreed students. Presenting preservice teachers with a list of goals to be ranked in order of importance would also be illustrative.

With a greater understanding of preservice as well as inservice teachers' gender differences, the profession can better meet the needs of its male and female students

while making teaching a more satisfying and fulfilling endeavor.

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